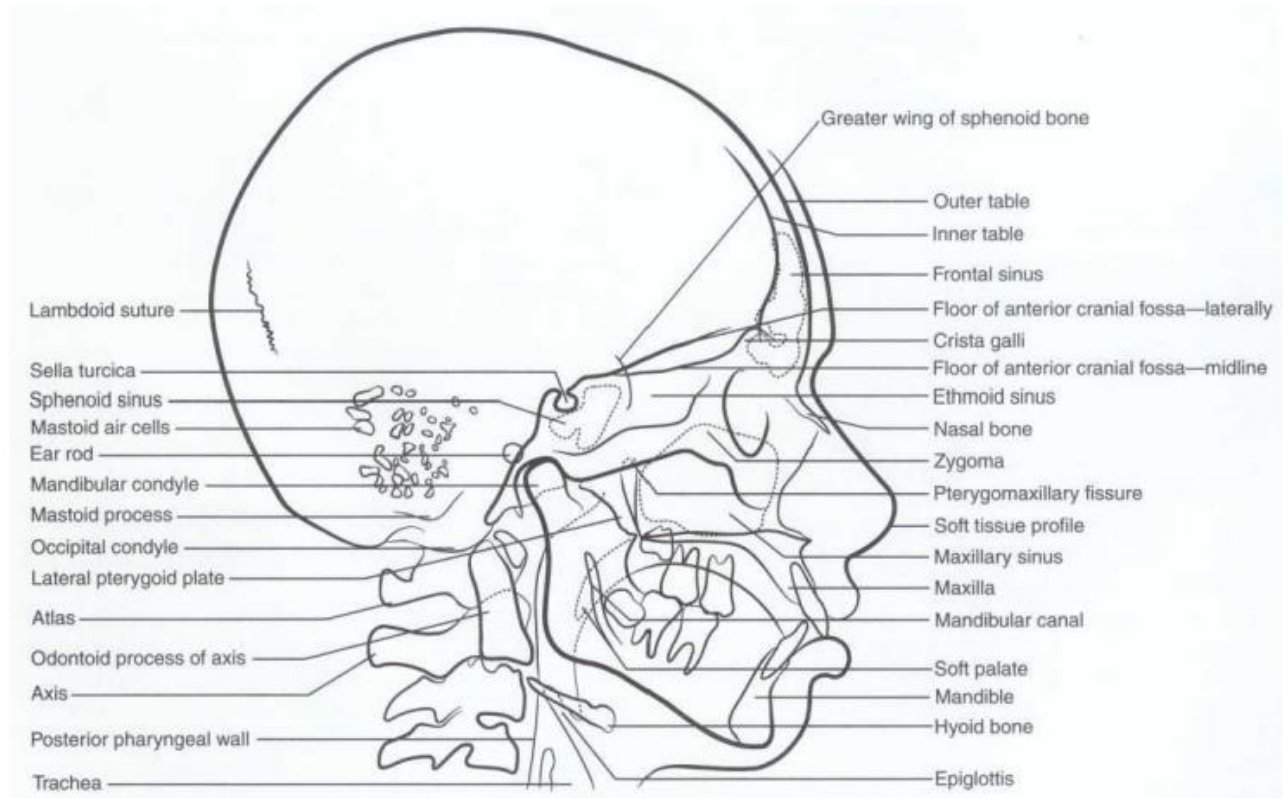


CEPHALOMETRIC RADIOGRAPHY

Cephalometric radiography is a standardized method of production of skull radiographs, which are useful in making measurements of the cranium and the orofacial complex. The radiograph thus obtained is called a cephalogram.



Uses of cephalometrics

1. Study of craniofacial growth: Serial cephalogram studies have helped in providing information regarding:
 - The various growth patterns.
 - The formation of standards, against which other cephalograms can be compared.
 - Prediction of future growth.
 - Predicting the consequences of a particular treatment plan.
2. Diagnosis of craniofacial deformity: Cephalograms help in identifying, locating and quantifying the nature of the problem, the most important result being a differentiation between skeletal and dental mal-relationships.
3. Treatment planning: By helping in diagnosis and prediction of craniofacial morphology and future growth, cephalometries help in developing a clear treatment plan. Even prior to starting orthodontic treatment an orthodontist can predict the final position of each tooth within a given patient's craniofacial skeleton to achieve aesthetic and more stable results. It helps in distinguishing cases which can be treated with growth modification appliances or which may require orthognathic surgery in future.

4. Evaluation of treated cases: Serial cephalograms permit the orthodontist to evaluate and assess the progress of treatment and also helps in guiding any desired change.

5. Study of relapse in orthodontics: Cephalometries also helps in identifying causes of orthodontic relapse and stability of treated malocclusions. It helps in establishing positions of individual teeth within the maxilla or the mandible, which can be considered to be relatively stable.

Cephalometric views

Lateral projection: The mid-sagittal plane of the subject's head is conventionally placed at 60 inches (152.4 cm) from the target of the X-ray tube with the left side (European convention is the right side) of the subject towards the film.

Postero-anterior projection: The head is rotated by 90 degrees so that the central ray perpendicularly bisects the trans-metal axis.

Cephalometry makes use of certain landmarks or points on the skull, which are used for quantitative analysis and measurements. The landmarks used in cephalometrics are of two broad categories: hard tissue landmarks and soft tissue landmarks. Some of the hard tissue landmarks are unilateral while others are bilateral.

Hard Tissue Landmarks

Nasion (N)

Code/Abbreviation: Nasion is abbreviated as N (Capital alphabet).

Definition: Nasion is the most anterior point of frontonasal outline in the midline.

Orbitale (Or)

Code/Abbreviation: Orbitale is abbreviated as Or (Capital alphabet O followed by small r) **Definition:** The lowest point on the inferior bony margin of the orbit.

Anterior Nasal Spine (ANS)

Code: Anterior nasal spine is abbreviated as ANS (all capital letters).

Definition: Anterior nasal spine is the tip of bony anterior nasal spine in the midline or median plane.

Point A (A)

Code: Point A is abbreviated as point A itself. **Definition:** Point A is the deepest point on the curved bony outline between the anterior nasal spine (ANS) and prosthion.

Prosthion (Pr)

Code: Prosthion is abbreviated as Pr (Capital P followed by small r). **Definition:** It is the lower most anterior point of alveolar process of pre-maxilla in the midline between two central incisors.

Anterior Point of Occlusion (APOcc)

Code: APOcc (Capital APO followed by double small c). **Definition:** Anterior point of occlusal plane is the midpoint in the incisors overbite in the occlusion.

Infradentale (Id)

Code: Infradentale is abbreviated as Id (Capital I followed by small d).

Definition: Infradentale is the highest anterior point of the alveolar process of mandible between two central incisors in midline.

Point (B)

Code: Point B is abbreviated as point B itself. **Definition:** It is the deepest point of curvature on the contour of mandibular alveolar process in the middle between infradentale and pogonion.

Pogonion (Pog)

Code: Pogonion is abbreviated as Pog (Capital P followed by small o and g).

Definition: Pogonion is the most anterior point of the bony chin in the midline.

Gnathion (Gn)

Code: Gnathion is abbreviated as Gn (Capital G followed by small n). **Definition :** It is the most anterior and inferior point of the bony chin. It is constructed by intersecting a line drawn perpendicularly to the line connecting menton and pogonion with bony outline.

Menton (Me)

Code: Menton is abbreviated as Me (Capital M followed by small e).

Definition: According to Krogman and Sassouni, Menton is the most caudal point in the outline of the symphysis. It is regarded as the lowest point of the mandible.

Sella (S)

Code: Sella is abbreviated as S (capital letter 'S'). **Definition:** Sella is the midpoint of sella turcica or hypophyseal fossa or pituitary fossa.

Se (Se)

Code: Se is abbreviated as Se (Capital S followed by small e). **Definition:** Se is the mid-entrance point of sella turcica or pituitary fossa.

Pterygomaxillary Fissure (Ptm)

Code: Pterygomaxillary fissure is abbreviated as Ptm (Capital P followed by small t and m). **Definition:** It is the intersection of the inferior border of the foramen rotundum with the posterior wall of the pterygomaxillary fissure.

Posterior Nasal Spine (PNS)

Code: Posterior nasal spine is abbreviated as PNS (all capital letters). **Definition:** It is the intersection of a continuation of the anterior wall of the pterygopalatine fossa and the floor of the nose.

Posterior Point of Occlusion (PPOcc)

Code: Posterior point of occlusion is abbreviated as PPOcc (capital PPO followed by small double c). **Definition:** Posterior point for the occlusal plane is the most distal point of contact between the most posterior molar in occlusion.

Articulare (Ar)

Code: Articulare is abbreviated as Ar (capital A followed by small r). It was introduced by Björjö (1947). **Definition:** Articulare is the point of intersection of the posterior margin of the ascending ramus and the outer margin of the cranial base.

Condylion (Cd)

Code: Condylion is abbreviated as Cd (Capital C followed by small d). **Definition:** It is the superior most point of the head of the condyle of the mandible.

Gonion (Go)

Code: Gonion is abbreviated as Go (Capital G followed by small o).

Definition: Gonion is the intersection of the lines tangent to the posterior margin of the ascending ramus and the mandibular base.

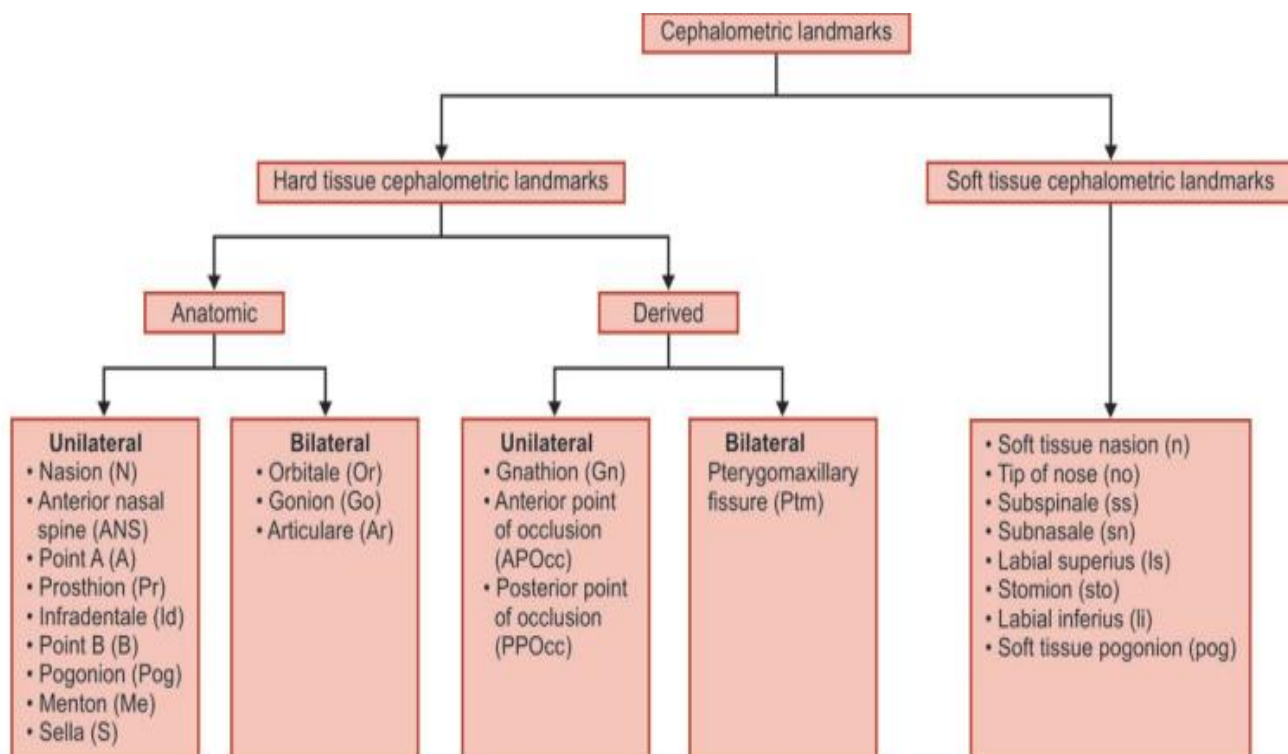
Porion (Po)

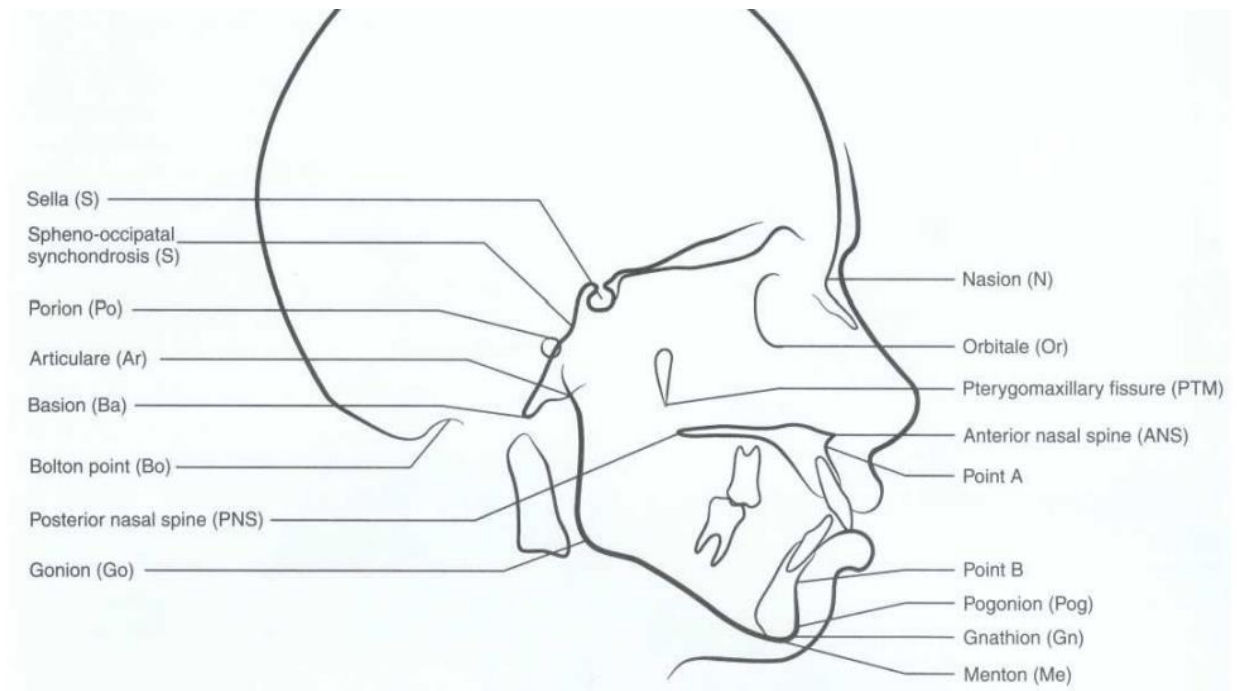
Code: Porion is abbreviated as Po (Capital P and small o). **Definition:** It is the midpoint on the upper edge of the porus acusticus externus located by means of the metal rods on the cephalometer.

Basion (Ba)

Code: Basion is abbreviated as Ba (Capital B followed by small a).

Definition: Basion is the lowest point on the anterior margin of the foramen magnum in the midline.





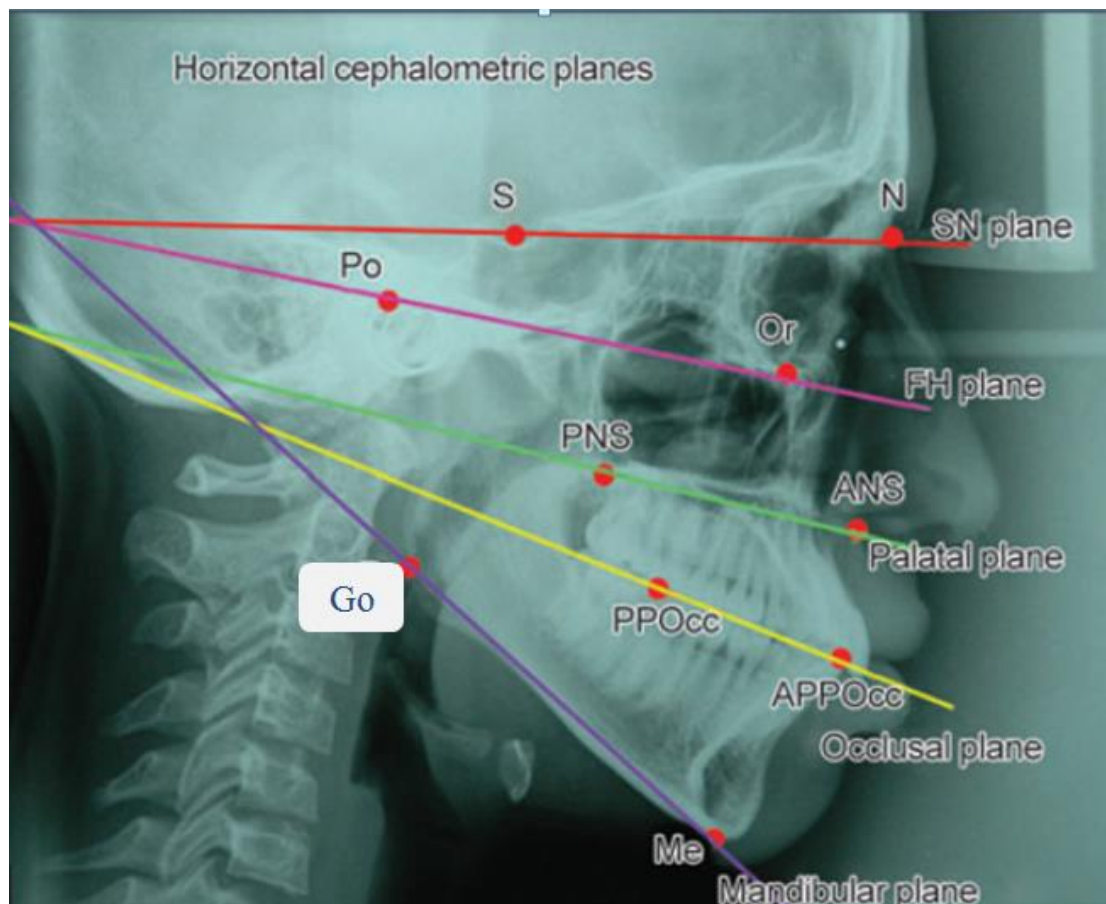
Cephalometric planes:

Reference planes are classified into the following two groups:

1. Horizontal cephalometric reference planes
2. Vertical cephalometric reference planes.

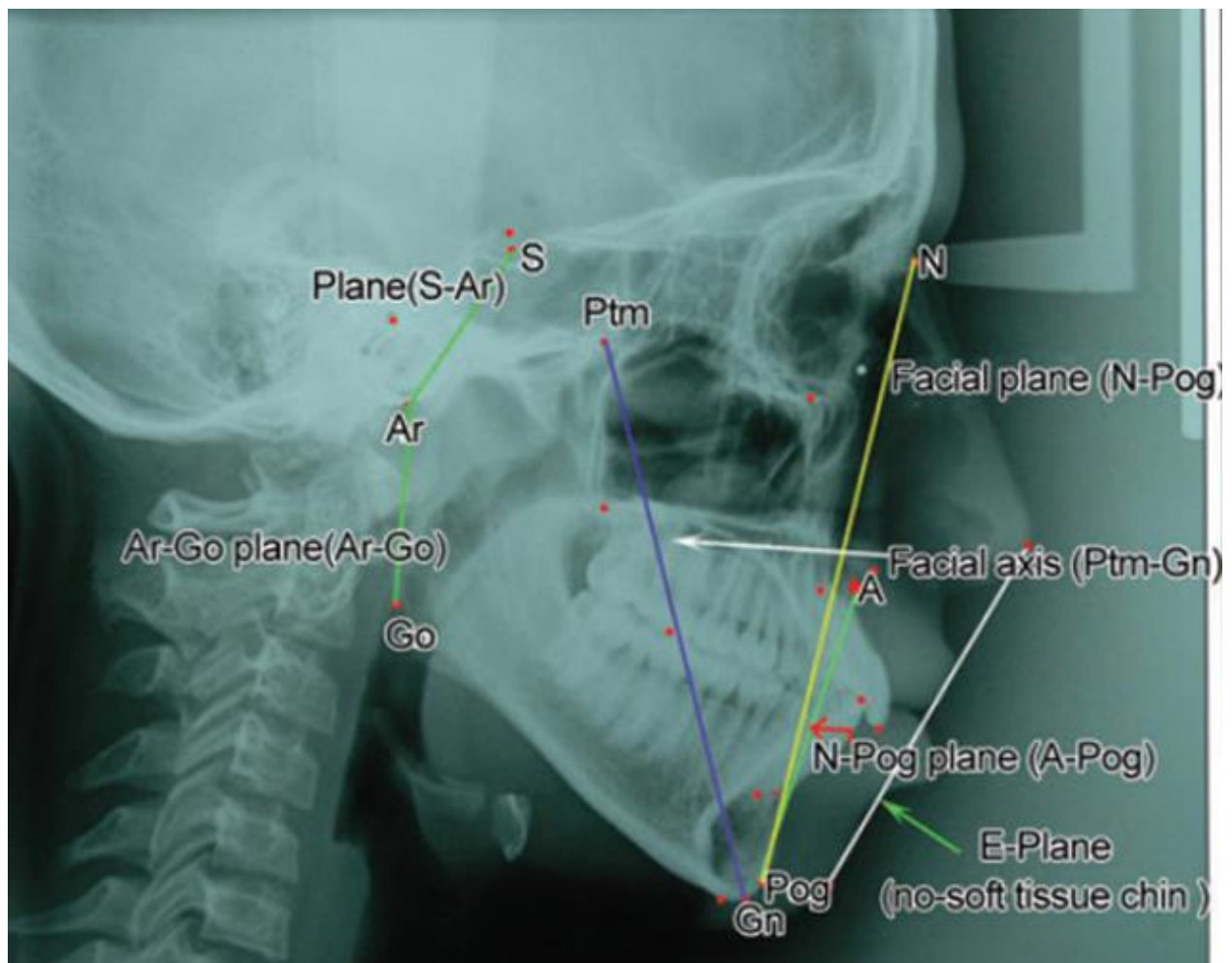
Horizontal Cephalometric Reference Planes

1. **Frankfort Horizontal Plane:** It is drawn from the point orbitale to the superior most point on the external auditory meatus (Porion).
2. **S-N Line-** The S-N line represents the anterior cranial base. It is constructed by connecting the points sella turcica and the Nasion.
3. **Palatal Plane:** The palatal plane is drawn by extending a line from the anterior nasal spine (ANS) to posterior nasal spine(PNS).
4. **Occlusal Plane (Functional OP, Anatomic OP):** It was originally described as the line connecting the molars in occlusion to the bisector of the overbite (vertical overlap of the incisors anteriorly), also known as the anatomic occlusal plane. It was later modified to be represented by the line passing through the occlusion of the premolars and the molars, also known as the functional occlusal plane.
5. **Mandibular Plane:** Mandibular planes have been defined by various authors based upon their clinical experience and use in their cephalometric analyses. Tweed described the mandibular plane as a line that is a tangent to the inferior border of the mandible. Down considered the mandibular plane to represent a line connecting the points gonion and menton. Steiner drew the mandibular plane by joining the points Gonion and Gnathion.



Vertical Cephalometric Reference Planes

1. **A-Pog Line:** It is a line from point A on the maxilla to pogonion on the mandible.
1. **Facial Plane:** It is a line from the anterior point of the frontonasal suture (nasion) to the most anterior point of the mandible (pogonion).
2. **Facial Axis:** A line from Ptm point to cephalometric gnathion.
3. **E-Plane:** E-plane is also called esthetic plane and it is a line between the most anterior point of the soft tissue nose and chin.
4. **S-Ar Plane:** It is the plane between the sella point (center of sella turcica) and the Ar (articulare) point. This plane represents the lateral extent of cranial base.
5. **Ar-Go Plane:** Ar-Go plane is formed by the line connecting from articulare (Ar) to the gonion (Go). This plane is important in the determination of length of ramus.



The Skeletal Analysis

Relating the Maxilla to the Skull

The angle SNA is formed by joining the lines S-N and N-A. The mean reading for this angle is 82° . If the angular reading is more than 82° , it would indicate a relative forward positioning or protrusion of the maxilla. Conversely, should the reading be less than 82° , it would indicate a relative backward or recessive location of the maxilla.

Relating the Mandible to the Skull

To assess whether the mandible is protrusive or recessive relative to the cranial base, the SNB angle is read. The mean for this angle is 80° . If the angle is less than 80° , it is indicative of a retruded mandible. An angle greater than 80° suggests a prognathic or forwardly positioned mandible.

Relating the Maxilla to the Mandible

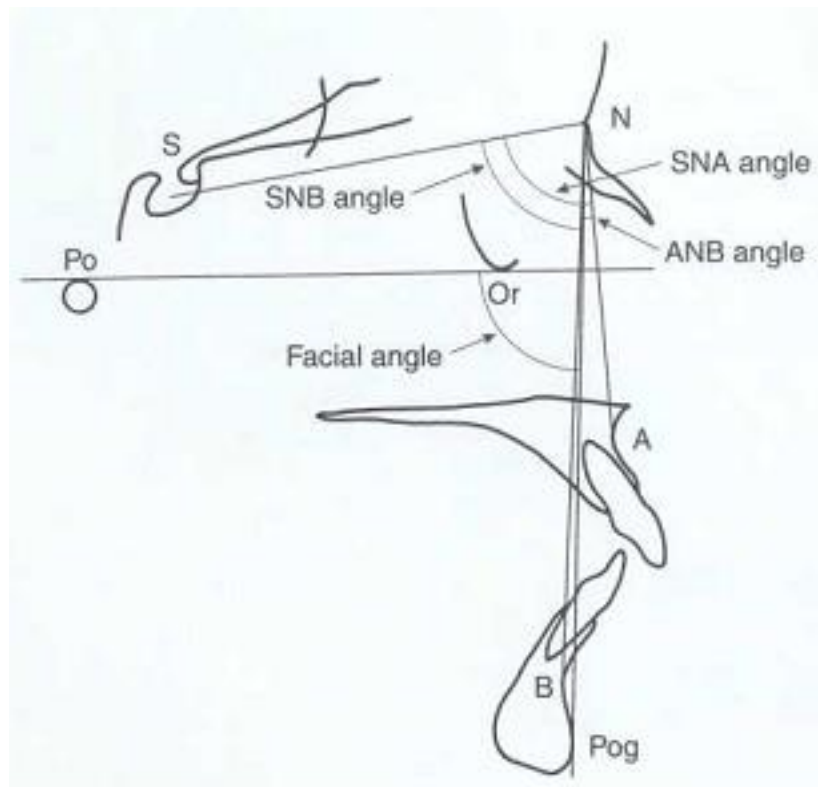
The angle ANB, provides information on the relative positions of the jaws to each other. The ANB angle provides a general idea of the antero-posterior discrepancy of the maxillary to the mandibular apical bases. The mean reading for this angle is 2° . A reading greater than 2° indicates a Class II skeletal tendency. As a rule, the larger the number, the greater the antero-posterior jaw discrepancy, and hence the greater the difficulty in correcting a malocclusion. Angles less than 2° and readings of below zero (e.g. $-1^\circ, -2^\circ$) indicate that the mandible is located ahead of the maxilla, suggesting a Class III skeletal relationship.

Occlusal Plane Angle

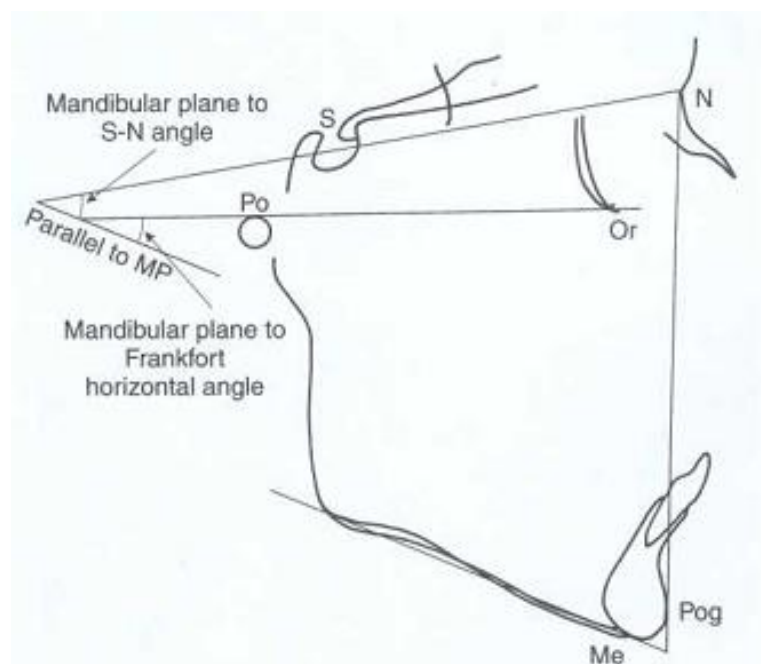
The occlusal plane is drawn through the region of the overlapping cusps of the first premolars and first molars. The angle of the occlusal plane to S-N plane is measured. The mean reading for normal occlusions is 14° . The angle is increased in long face or vertically growing individuals and also skeletal open bite cases. It may be decreased in horizontally growing individuals or cases with a skeletal deep bite.

Mandibular Plane Angle

The mandibular plane is drawn between Gonion (Go) and Gnathion (Gn). The mandibular plane angle is formed by joining the mandibular plane to the anterior cranial base (S-N plane). The mean reading for this angle is 32° . Excessively high (vertical growers) or low (horizontal growers) mandibular plane angles are suggestive of unfavourable growth patterns and these may complicate treatment results.



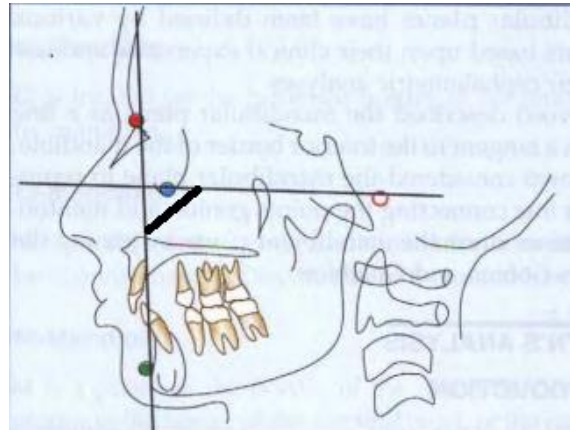
Angles relating the anterior cranial base to the maxilla and mandible.



Different mandibular plane to other plane angles.

Facial Angle

The facial angle is used to measure the degree of retrusion or protrusion of the lower jaw. The facial angle provides an indication of the degree of recession or protrusion of the mandible in relation to the upper face. Facial angle is the inferior inside angle formed by the intersection of the facial line (Nasion-Pogonion) to the Frankfort Horizontal (FH) Plane. The mean reading for this angle is $87.8^\circ (\pm 3.6^\circ)$ with a range of 82° to 95° . A prominent chin increases this angle, whereas a smaller than average angular reading suggests a retrusive or retro-positioned chin.



Angle of Convexity

The angle of convexity is formed by the intersection of line N-point A to point A-Pogonion. This angle measures the placement of the maxillary basal arch at its anterior limit (point A) relative to the total facial profile (Nasion-Pogonion). This angle is read in plus or minus degrees starting from zero. If the line Pogonion-point A is extended and located anterior to the N-A line, the angle is read as positive. A positive angle suggests prominence of the maxillary denture base relative to the mandible. A negative angle of convexity is associated with prognathic profile or in other words a Class III profile. The range extends from -8.5° to $+10^\circ$, with a mean of 0° .

